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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/450,351 | 11/29/1999 | TOMOE YAMAMOTO | SHM-00901 | 7516 |

26339 7590 10/18/2004
PATENT GROUP
CHOATE, HALL & STEWART
EXCHANGE PLACE, 53 STATE STREET
BOSTON, MA 02109

EXAMINER

TSAL, H JEY

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| ART UNIT | PAPER NUMBER |
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2812

DATE MAILED: 10/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/450,351

Applicant(s)

YAMAMOTO, TOMOE

Examiner

H.Jey Tsai

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 8/4/2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 and 13-36 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 and 13-36 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-17, 22-26 and 30-36 are rejected under 35 U.S.C. § 102(e) as being anticipated by Nishikawa et al. 6,087,261, previously cited.

Nishikawa et al. teaches a method for forming a semiconductor device having a laminated structure including a dielectric film made from a tantalum metal oxide 123 (see fig. 3D, col. 6, lines 2+) formed on a surface of a heated substrate and a CVD high melting point titanium metal nitride film 124 (TiN-CVD), is directly formed on the tantalum metal oxide 123 by introducing a source gas containing (TiCl₄, col. 6, lines 25-33) into a chamber in which substrate is contained, the method comprising:

a step of heating the substrate (col. 6, lines 29, col. 9, lines 1-5 and figs. 6-7, at 500 °C, pressure at 150mTorr, or 0.15Torr) in a non-reactive ambient having no component that reacts with tantalum metal oxide 123 formed on the surface of the substrate in the chamber (see col. 12, lines 1-4, the **conventional technique** under the same conditions as shown in figures 6-7, excepting it **omits the introduction of oxygen**), the non-reactive ambient includes a member of the group consisting of a gas non-reactive (inert gas He and NH₃, 30 sccm, col. 9, lines 30+, col. 16, line 26) with respect the tantalum metal oxide contained in the dielectric film and NH₃ gas, note: in

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fig. 6-7, first introducing He and NH₃ at 0.15 Torr at the elapse time 30 sec, then introducing TiCl₄ at elapse time 35 sec,

introducing into the chamber a source gas TiCl₄, 5-20 sccm, for forming CVD-TiN film and NH₃ gas, 30 sccm, following the heating step, and further

a temperature of the substrate is set at a prescribed temperature at 500 °C, before the source gas containing the high melting point metal (TiCl₄ or WN, col. 14, lines 51-55), is introduced into the chamber, col. 6, line 29,

mass flow controller for stabilizing gas flow into chamber, fig. 6, col. 8, lines 34-64.

Claims 1-4, 11, 13-17, 19-20 and 30-31 are rejected under 35 U.S.C. § 102(e) as being anticipated by Tamaru et al. 6,103,566, previously cited.

Tamaru et al. teaches a method for forming a semiconductor device having a laminated structure including a dielectric film made from a tantalum metal oxide 77 (see fig. 34, col. 16, lines 8+) formed on a surface of a heated substrate and a CVD high melting point titanium metal nitride film 79 (TiN-CVD electrode), no passivation layer is formed, see fig. 40-42, col. 16, lines 15-21 and col. 17, lines 16-22) is directly formed on the tantalum metal oxide 77 by introducing a source gas containing (TiCl₄) into a chamber in which substrate is contained, the method comprising:

a step of heating the substrate (col. 16, lines 22-27) in a non-reactive ambient having no component that reacts with tantalum metal oxide 77 formed on the surface of the substrate in the chamber, the non-reactive ambient includes a member of the group

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consisting of a gas non-reactive (inert gas, He, Ar or N₂, col. 16, line 26) with respect the tantalum metal oxide contained in the dielectric film and NH₃ gas, col. 16, lines 22-27, **Note:** the Ti passivation layer is not formed, see fig. 40-42, col. 17, lines 16-22, also see claims 7-9, 14-17,

introducing into the chamber a source gas for forming CVD-TiN film and NH₃ gas, following the heating step, col. 16, lines 15-21, col. 16, lines 32-38, and further

a temperature of the substrate is set at a prescribed temperature, before the source gas containing the high melting point metal is introduced into the chamber, col. 16, lines 60-67,

mass flow controller for stabilizing gas flow into chamber, fig. 18 and col. 9, lines 25+.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 18-21 and 27-29 are rejected under 35 U.S.C. 103 as being unpatentable over Nishikawa et al. 6,087,261 as applied to claims 1-17, 22-26 and 30-36 above, and further in view of Kang et al. 6,139,700 and Asano et al. 6,268,985, newly cited.

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The difference between the references applied above and the instant claim(s) is: Nishikawa et al. teaches forming a WN layer for capacitor upper electrode but does not teaches using a source gas of WF_6 and using a TiN layer as gate electrode. However, Kang et al. teaches at col. 6, lines 2-65 that forming a WN layer with WF_6 source gas and NH_3 gas. And, Asano et al. teaches at col. 15, lines 1-3, using a TiN as a gate electrode 108A.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings by using WF_6 source gas and NH_3 gas to for a WN layer as taught by Kang et al. because WN layer can be formed with CVD method that is compatible with tantalum oxide capacitor dielectric layer and using TiN layer as a gate electrode layer as taught by Asano et al. because TiN layer is metal layer that increases the conductivity of gate electrode.

Information disclosure statement

The information disclosure statement filed Feb. 11, 2004 fails to submit English translation on the foreign publications for consideration by the Office. It has been placed in the application file, but the information referred to therein has not been considered.

Conclusion

Applicant's arguments filed on Feb. 11, 2004 have been fully considered but they are not persuasive because Nishikawa et al. clearly teaches using a non-reactive (inert) gas, such as He, that is not react to metal oxide layer and a NH_3 in the heating step as

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set forth above. Tamaru et al. also teach using at least of inert gas, such as helium, argon or nitrogen, that is not react to the metal oxide layer as set forth above. And, Nishikawa et al. clearly teaches a **conventional technique** at col. 12, lines 1-4 for forming TiN layer over a tantalum oxide layer under the same conditions as shown in figures 6-7, excepting it **omits the introduction of oxygen**), the non-reactive ambient includes a member of the group consisting of a gas non-reactive (inert gas He and NH₃, 30 sccm, col. 9, lines 30+, col. 16, line 26) with respect the tantalum metal oxide contained in the dielectric film and NH₃ gas. It is noted that in fig. 6-7, first introducing He and NH₃ at 0.15 Torr and substrate temperature at 500 °C at the elapse time 30 sec, then introducing TiCl₄ at elapse time 35 sec as set forth above.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry of a general nature or clerical matters or relating to the status of this application or proceeding should be directed to the Group customer service whose telephone number is (703) 308-4357.

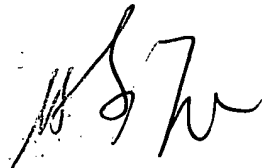
Any inquiry concerning this communication or earlier communications from the examiner should be directed to H. Jey Tsai whose telephone number is (571) 272-1684. The examiner can normally be reached on from 7:00 Am to 4:00 Pm., Monday thru Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on (571) 272-1679.

The fax phone number for this Group is (703) 872-9306.

hjt

10/5/04



H. Jey Tsai
Primary Examiner
Patent Examining Group 2800